Status of Sacramento River Winter Run Chinook Salmon: What is Needed to Achieve Viability?

Steve Lindley
NOAA Fisheries
Southwest Fisheries Science Center
Director, Fisheries Ecology Division

Maria Rea
NOAA Fisheries
California Central Valley Office
Assistant Regional Administrator

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Winter-run Chinook salmon

Historical Distribution

- Historically: 4 populations
- Cold water spring fed rivers
Winter-run Chinook salmon

Current Distribution

- Currently: 1 population that is supplemented with hatchery production
- Persists due to cold water releases from Shasta Reservoir
## Viability criteria: populations

<table>
<thead>
<tr>
<th>Criterion</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extinction risk from PVA</td>
<td>&gt; 20% within 20 years</td>
<td>&gt; 5% within 100 years</td>
<td>&lt; 5% within 100 years</td>
</tr>
<tr>
<td></td>
<td>– or any ONE of –</td>
<td>– or any ONE of –</td>
<td>– or ALL of –</td>
</tr>
<tr>
<td>Population size(^a)</td>
<td>$N_e \leq 50$</td>
<td>50 &lt; $N_e$ ≤ 500</td>
<td>$N_e$ &gt; 500</td>
</tr>
<tr>
<td></td>
<td>– or –</td>
<td>– or –</td>
<td>– or –</td>
</tr>
<tr>
<td></td>
<td>$N \leq 250$</td>
<td>250 &lt; $N$ ≤ 2500</td>
<td>$N$ &gt; 2500</td>
</tr>
<tr>
<td>Population decline</td>
<td>Precipitous decline(^b)</td>
<td>Chronic decline or depression(^c)</td>
<td>No decline apparent or probable</td>
</tr>
<tr>
<td></td>
<td>Order of magnitude decline within one generation</td>
<td>Smaller but significant decline(^e)</td>
<td>Not apparent</td>
</tr>
<tr>
<td>Hatchery influence(^f)</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
</tbody>
</table>
Winter-run Chinook Salmon Adult Returns

- Graph showing the Escapement (Thousands) from 1970 to 2015.
- Graph showing the % Hatchery Origin from 1970 to 2015.
Winter-run Chinook salmon

Recovered Spawning Distribution

- 3 spawning areas, each meeting low extinction risk criteria
• Shasta Reservoir Temperature Management
• Battle Creek Restoration & Reintroduction
• McCloud River Reintroduction
• Yolo Bypass
• Delta Conditions
Winter-run Chinook Salmon Action Plan

Life cycle approach

Key actions are needed at each life stage
Winter-run Chinook Salmon Action Plan

Action 1:
Water temperature management for spawners, eggs, and fry
- Model advances (RAFT)
- Improved measurements
- Partnership with senior water rights holders/rice growers
- Physical modifications
  - Oak Bottom Temperature Curtain

Spawning & Egg Incubation

Sacramento River Migration & Rearing

Delta Migration & Rearing

Sub-adults & Adults in Ocean
Winter-run Chinook Salmon Action Plan

Action 2: Battle Creek Restoration and Reintroduction
Winter-run Chinook Salmon Action Plan

Action 3: McCloud River Reintroduction

Spawning & Egg Incubation
McCloud Pilot Reintroduction Fieldwork Framework

DRAFT: Shasta Fish Passage Fieldwork Coordination Team - Conceptual Fieldwork Framework
Winter-run Chinook Salmon Action Plan

Action 4: Improve Yolo Bypass Fish Habitat and Passage
Sacramento River


https://yolobypass.wikispaces.com/
Winter-run Chinook Salmon Action Plan

Action 5:
Managing Delta Conditions:
- Implement CVP/SWP operations to minimize reverse flows
- Continued commitment to science, monitoring, and adaptive management
- Real-time acoustic telemetry
- Particle tracking model
- Non-physical barriers

https://yolobypass.wikispaces.com/
Creating usable science in response to management drought challenges

- NMFS RPA relies on **seasonal planning and predictions**
- **Decision tree** approach that accounts for variability and has **performance metrics** to be achieved over time
- **February forecast** is key decision point to set allocations/operations – significant uncertainties in predicting summer temperatures. 90% goal.
- **May temperature plan** – want to optimize expenditure of cold water and predict survivals
- **Fall carryover storage and releases**
Drought Monitor 2011 - 2016

Source: https://www.drought.gov/drought/california
Lessons learned on Shasta Temp management

• Sensitivity of cold water to spring releases; partnership with rice growers to reschedule water
• Need enhanced coupled reservoir model to create better tool for February forecast decision to achieve 90% goal
• Assumptions on ambient air temps are important
• TCD – last side gate operation by Oct 15th is new planning metric
• Survival model based on lab data was not reliable for decision support in 2015
• 56 DAT over most downstream redd is not protective – looking at 55 7DADM
• Tracking weekly conditions against modeled predictions may create better management framework than real-time conditions alone.
Questions?
Evolution of information on Shasta Temperatures

2014: February standard temperature model predicted 56 degrees could be met throughout summer – in fact ran out of cold water in August.

Learning:
- Reschedule spring releases to rice to enhance cold water
- Added more conservative ambient temps to model
- Delay last side gate operation at TCD to Oct 15th,

2015: February standard temperature model predicted 56 could be met throughout summer, with buffer. Survival model predicted low mortality for 57 degrees. In fact, less cold water than predicted; significant mortalities in 2015

Learning:
- Need real-time fiber optic cable, coupled reservoir model with explicit uncertainties
- Develop new survival model using RAFT and RBDD data
- Explore causal mechanisms of high mortality
Evolution of information on Shasta Temperatures

• **2016** – Planned for colder temperatures at most downstream redd (55 7DADM as a “pilot”)

• Used 52 degrees at Keswick, real-time reservoir profiles, and spring storage targets to enhance existing model interpretations.

• Conservative approach to spring releases to account for uncertainties in lake stratification (new model in development)

• Summer management: tracked rate of expenditure of cold water against what was modeled. Triggers in plan.

Results: Successful temperature management
EXTRA SLIDES TO POTENTIALLY USE
Winter-run Egg Survival Probability

2012 Temperature-Dependent Survival

2013 Temperature-Dependent Survival

2014 Temperature-Dependent Survival

2015 Temperature-Dependent Survival
Historical floodplain ecosystem (TBI 1998)

Recent floodplain ecosystem (TBI 1998)
Juvenile fish get pulled towards pumps – poor survival
Reasons for hope

• Population is at moderate risk based on extinction risk criteria

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<tr>
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<th>2015 Status Review</th>
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<tbody>
<tr>
<td>Population Size</td>
<td>Low risk</td>
<td>Low risk</td>
</tr>
<tr>
<td>Population Decline</td>
<td>Low risk</td>
<td>Moderate risk</td>
</tr>
<tr>
<td>Catastrophe, rate, and effect</td>
<td>Low risk</td>
<td>Low risk</td>
</tr>
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<td>Hatchery Influence</td>
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• 2016 adults returns likely will still result in low risk based on population size (even with extreme drought and poor ocean conditions)
Winter-run Chinook Salmon Action Plan

Action 1: Water temperature management for spawners, eggs, and fry
- Model advances (RAFT)
- Improved measurements

(Do not want a repeat of 2014)
Non-physical barriers
Deter fish from entering the central Delta

http://www.ovivowater.com/
Winter-run Chinook salmon

Unique to Sacramento River

Life History

- Adult migration in winter
- Spawn in spring and summer
- Juveniles spend 5-10 months in freshwater
- Adults spend 1-2 years in ocean
Egg to Fry Survival (%)
Reasons for hope

• We’re learning a lot!
  • Water temperature management and egg survival
  • Life cycle modeling
  • Predation studies
  • Acoustic tracking
  • Monitoring gaps

• Significant partnerships in agreement on what key restoration needs to be done

• Species in the Spotlight initiative helping to focus existing funding (e.g., CVPIA)

• Restoration funding is increasing
  • CA Prop 1, Fisheries Restoration Grant Program
  • NOAA Restoration Center